

# Section 7.3

## Systems of Equations

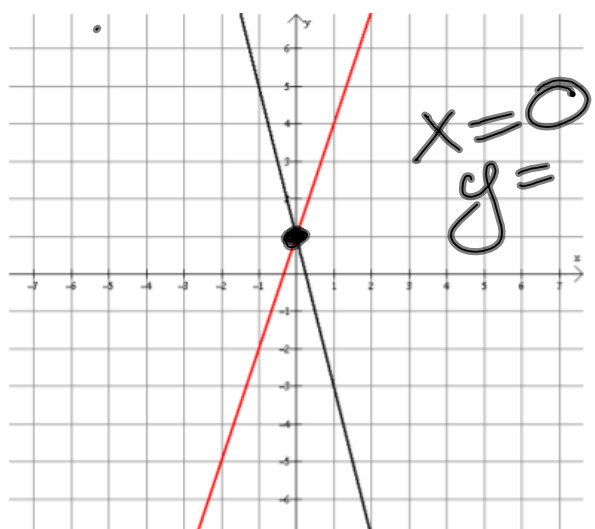
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### Solving Linear Systems by Substitution

In order to "solve" a linear system of equations we must find out when the 2 equations are equal. We have already looked at this last semester (intersection points - where the 2 graphs meet, they share points)

$$y = -4x + 1$$

$$y = 3x + 1$$



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## Solving Linear Systems by Substitution

Now we will look at the substitution method:

Pg. 325

1. take one equation and isolate a variable
2. substitute that expression into the other equation and solve
3. substitute the answer into first equation, then solve for the remaining variable

**EXAMPLE 1- Solve the following system of linear equations.**

$$2x = y - 1$$

AND

$$-3 + y = 3x$$

**STEP 1:**

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Solving Linear Systems by Substitution

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**EXAMPLE 1- Solve the following system of linear equations.**

$$2x = y - 1 \quad \text{AND} \quad -3 + y = 3x$$

**STEP 1:**

$$2x = y - 1$$
$$+1 \quad +1$$
$$y = 2x + 1$$

**STEP 2**

$$-3 + y = 3x$$
$$-3 + 2x + 1 = 3x$$
$$-2 + 2x = 3x$$
$$-2x \quad -2x$$
$$-2 = x$$

**Step 3**

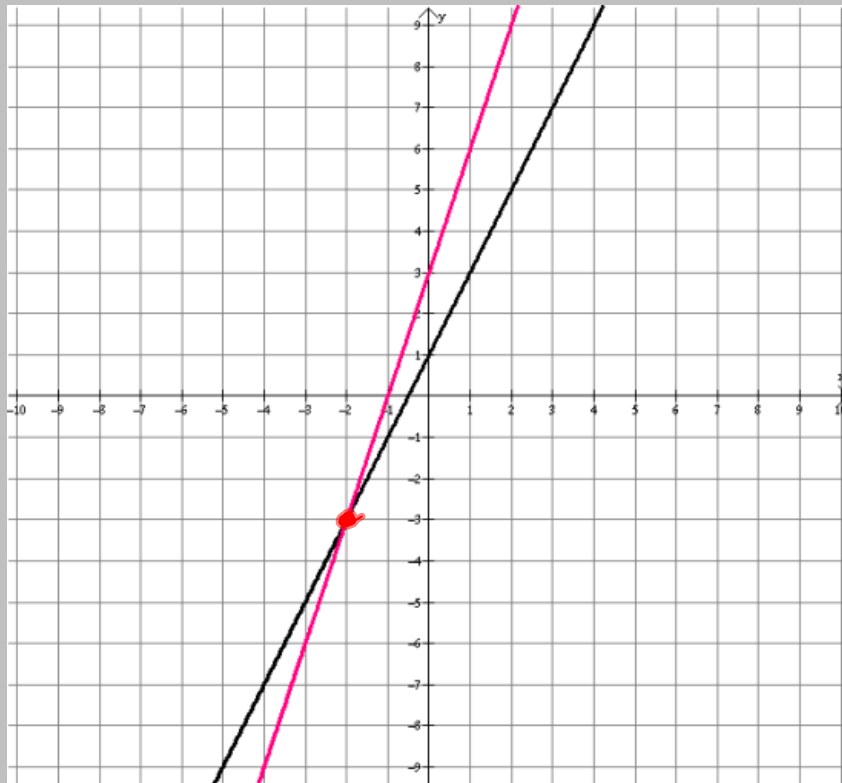
$$2x = y - 1$$
$$2(-2) = y - 1$$
$$-4 = y - 1$$
$$+1 \quad +1$$
$$y = -3$$

**Answer**

$$= (-2, -3)$$

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If we graph our 2 equations, we can check our answer....



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**Example 2: Solve the following system of linear equations:**

$$3x + y = 2$$

AND

$$20x + 5y = 50$$

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**Example 2: Solve the following system of linear equations:**

$$3x + y = 2$$

AND

$$20x + 5y = 50$$

Step 1:

$$\begin{array}{r} 3x + y = 2 \\ -3x \quad -3x \end{array}$$

$$y = -3x + 2$$

Step 2:

$$20x + 5y = 50$$

$$20x + 5(-3x + 2) = 50$$

$$20x - 15x + 10 = 50$$

$$\begin{array}{r} 5x + 10 = 50 \\ -10 \quad -10 \end{array}$$

$$\begin{array}{r} 5x = 40 \\ \frac{5x}{5} = \frac{40}{5} \end{array} \quad x = 8$$

Step 3

$$3x + y = 2$$

$$3(8) + y = 2$$

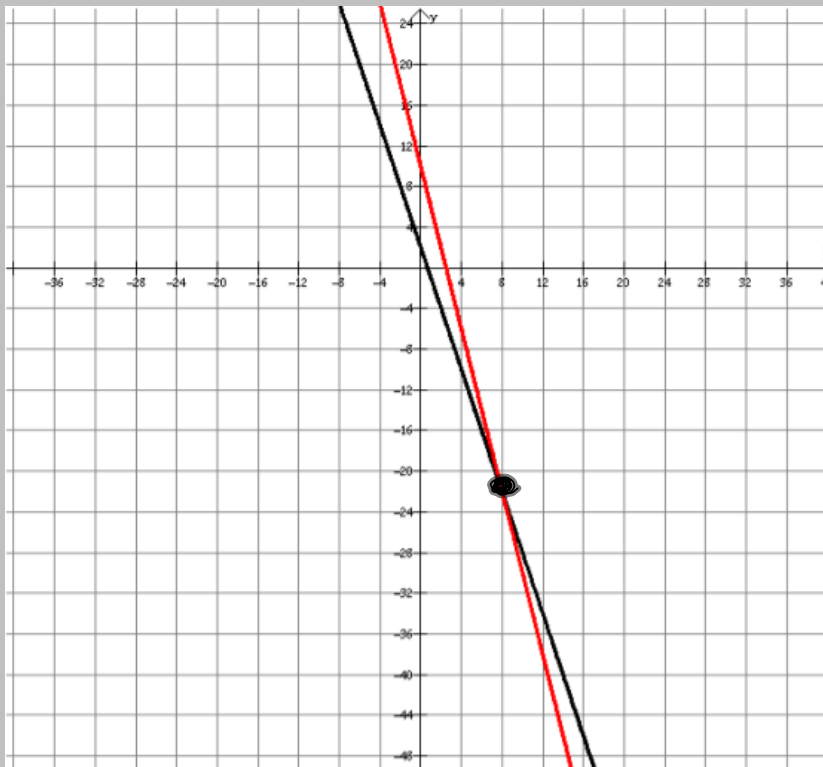
$$\begin{array}{r} 24 + y = 2 \\ -24 \quad -24 \end{array}$$

$$y = -22$$

$(8, -22)$

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**If we graph our 2 equations, we can check our answer....**



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## Classwork/Homework

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#11a)  $y = 2x - 1$   $y = 4x - 3$

$$\begin{array}{r} 2x - 1 = 4x - 3 \\ -2x \quad -2x \\ -1 = 2x - 3 \\ +3 \quad +3 \\ 2 = 2x \\ \underline{2} \quad \underline{2} \quad x=1 \end{array} \quad (1, 1)$$

$y = 2x - 1$   
 $y = 2(1) - 1$   
 $y = 2 - 1$   
 $y = 1$

b)  $4x - y + 5$   $2y = -4x - 22$

$$\begin{array}{r} y = -4x + 5 \\ 2y = -4x - 22 \\ 2(-4x + 5) = -4x - 22 \\ -8x + 10 = -4x - 22 \\ +8x \quad +8x \\ 10 = 4x - 22 \\ +22 \quad +22 \\ 32 = 4x \\ \underline{32} \quad \underline{4} \quad x=8 \end{array} \quad (8, 27)$$

$4x = -y + 5$   
 $4(8) = -y + 5$   
 $32 = -y + 5$   
 $-5 = -y - 5$   
 $27 = -y$   
 $y = -27$

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c)  $y = 0.5x + 2.5$   $6.5 = 3.5x - y$

$$\begin{array}{r} 6.5 = 3.5x - y \\ 6.5 = 3.5x - (0.5x + 2.5) \\ 6.5 = 3.5x - 0.5x - 2.5 \\ 6.5 = 3x - 2.5 \\ +2.5 \quad +2.5 \\ 9 = 3x \\ \underline{9} \quad \underline{3} \quad x=3 \end{array} \quad (3, 4)$$

$y = 0.5x + 2.5$   
 $y = 0.5(3) + 2.5$   
 $y = 1.5 + 2.5$   
 $y = 4$

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$$\begin{aligned}
 d) \quad 2y - 6x &= 1 & y &= \frac{1}{4}x + 4 \\
 & & y &= 0.25x + 4 \\
 2y - 6x &= 1 \\
 2(0.25x + 4) - 6x &= 1 \\
 0.5x + 8 - 6x &= 1 \\
 -5.5x + 8 &= 1 \\
 -5.5x &= -7 \\
 \frac{-5.5x}{-5.5} &= \frac{-7}{-5.5} & x &= 1.27 \\
 & & & (1.27, 4.32) \\
 y &= 0.25x + 4 \\
 y &= 0.25(1.27) + 4 \\
 y &= 0.317 + 4 \\
 y &= 4.317
 \end{aligned}$$

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